Docket No. HOE97/F151US

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Forbert et al.	Group Art Unit:	1793
Serial No.:	09/447,030	Examiner:	Nguyen, Ngoc Yen M.
Filed:	November 22, 1999	Confirmation No.:	3281

For: **METHOD FOR PRODUCING SUBSTANTIALLY GLOBULAR LYOGELS AND AEROGELS**

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
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APPELLANTS' BRIEF ON APPEAL

This is an appeal to the Board of Patent Appeals and Interferences from the decision of the Examiner in the Final Office Action dated June 27, 2008 rejecting claims 14-22 and 26-28 of the above-identified patent application. A Combined Notice of Appeal and Petition for Extension of Time was filed on December 22, 2008 and received by the USPTO on that date.

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I. THE REAL PARTY IN INTEREST

The real party in interest besides the named inventors is Cabot Corporation.

II. RELATED APPEALS AND INTERFERENCES

No other appeal or interference that will directly effect or be effected by or have a bearing on the Board's decision in this appeal is known to the Appellants, the Appellants' legal representative, or the assignee.

III. STATUS OF CLAIMS

Claims 1-13 and 23-25 were previously cancelled. Claims 14-22 and 26-28 are pending in this application and have been finally rejected. All pending claims are on appeal. A copy of the claims on appeal can be found in the attached Claims Appendix.

IV. STATUS OF AMENDMENTS

Two Preliminary Amendments were submitted on February 26, 2001, in which original claims 1-12 were cancelled and new claims 13-24 were filed. Appellants received an Office Action mailed March 28, 2001, and Appellants filed an Amendment in Response on October 22, 2001. On June 14, 2002, Appellants received a Final Office Action to which a Response was filed on August 29, 2002. Appellants also received an Advisory Action on September 24, 2004. After submitting a Notice of Appeal on October 14, 2002 an Appeal Brief on February 14, 2003, and a Reply Brief on July 7, 2003 (in response to an Examiner's Answer dated May 6, 2003), Appellants received a Decision on Appeal mailed September 30, 2003.

Appellants then filed a Request for Continued Examination on November 25, 2003, providing a Preliminary Amendment, which was resubmitted on January 12, 2004. After receiving a Final Office Action mailed March 2, 2004, Appellants filed a Notice of Appeal on August 2, 2004, followed by a Request for Continued Examination on January 3, 2005, which included an Amendment and Response in which new claim 25 was submitted. Appellants subsequently received an Office Action mailed January 12, 2005, to which an Amendment and Response was filed on July 12, 2005, including new claims 26-27, and then further received a Final Office Action mailed October 7, 2005, to which a Notice of Appeal was filed on March 6, 2006, followed by a Request for Continued Examination on August 7, 2006, which included an Amendment and Response in which new claim 28 was submitted.

After receiving an Office Action mailed October 11, 2006, Appellants met with the Examiner to interview the application on March 23, 2007. Following these helpful discussions, Appellants filed an Amendment and Response on July 3, 2007. Finally, Appellants received a Final Office Action mailed June 27, 2008, and Appellants filed a Notice of Appeal on December 22, 2008.

No additional amendments were filed.

V. SUMMARY OF CLAIMED SUBJECT MATTER

The present invention relates to a method of producing substantially globular lyogels and aerogels. The method comprises the steps of mixing gel forming components together to form a lyosol and then introducing the lyosol into a moving medium to form the substantially globular lyogel, which can be further converted to an aerogel.

Concise Explanation of the Subject Matter Defined in the Claims

1) Claims 14-22 and 26

Independent claim 26 recites a method of producing substantially globular (paragraph spanning pages 4 and 5) aerogels (page 1, 3rd and 4th paragraphs) wherein i) gel forming components (page 6, last paragraph, to page 7, 1st full paragraph as well as page 2, 4th and last paragraphs, page 3, 4th paragraph, and the paragraph spanning pages 4 and 5) are mixed to produce a lyosol (page 5, 3rd full paragraph); ii) the lyosol is introduced into an atmosphere (page 5, 2nd full paragraph and the paragraph spanning pages 5 and 6) which flows substantially against the direction of gravity (page 6, 2nd full paragraph) to form a substantially globular lyogel; and iii) the substantially globular lyogel is converted to an aerogel (page 7, 2nd, 3rd, and 5th full paragraphs).

Claims 14-22 depend directly or indirectly from claim 26 and recite further embodiments of the invention. Claims 14 and 15 recite specific features of the atmosphere (paragraph spanning pages 5 and 6). Claim 17 recites a specific method of introducing the lyosol (page 6, 1st full paragraph). Claim 18 recites that the lyosol is screened according to size by the air (page 6, 2nd full paragraph). Claim 19 recites that the air has a velocity that diminishes in the direction of the flow (page 6, 3rd full paragraph). Claim 20 recites that the resulting globular lyogel is trapped in a layer of water (page 6, 4th and 5th full paragraphs). Claims 21 and 22 recite specific gel forming components (page 7, 1st full paragraph).

2) Claim 27

Independent claim 27 recites a method of producing substantially globular (paragraph spanning pages 4 and 5) silylated lyogels wherein i) gel forming components (page 6, last paragraph, to page 7, 1st full paragraph as well as page 2, 4th and last paragraphs, page 3, 4th paragraph, and the paragraph spanning pages 4 and 5) are mixed to produce a lyosol (page 5, 3rd full paragraph); ii) the lyosol is introduced into an atmosphere (page 5, 2nd full paragraph and the paragraph spanning pages 5 and 6) which flows substantially against the direction of gravity (page 6, 2nd full paragraph) to produce a substantially globular lyogel; and iii) the substantially globular lyogel is reacted with a silylating agent (page 7, 4th full paragraph) to form a substantially globular silylated lyogel.

3) Claim 28

Independent claim 28 recites a method of producing substantially globular (paragraph spanning pages 4 and 5) aerogels (page 1, 3rd and 4th paragraphs) wherein i) gel forming components (page 6, last paragraph, to page 7, 1st full paragraph as well as page 2, 4th and last paragraphs, page 3, 4th paragraph, and the paragraph spanning pages 4 and 5) are mixed to produce a hydrosol (page 5, 3rd full paragraph); ii) the hydrosol is introduced into an atmosphere (page 5, 2nd full paragraph and the paragraph spanning pages 5 and 6) which flows substantially against the direction of gravity (page 6, 2nd full paragraph) to form a substantially globular hydrogel; and iii) the substantially globular hydrogel is converted to an aerogel (page 7, 2nd, 3rd, and 5th full paragraphs). The hydrosol is formed from silicic acid and mineral acid (page 7, 1st full paragraph), and the substantially globular hydrogel is trapped in a layer of water (page 6, 4th and 5th full paragraphs).

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

The issues on appeal are as follows:

i) whether claims 14-22, 26, and 28 are patentable under 35 U.S.C. § 103(a) over Marisic (U.S. Patent No. 2,384,946) in view of Fernholz et al. (U.S. Patent No. 3,939,199) and optionally further in view of Mielke et al. (U.S. Patent No. 5,656,195); and

ii) whether claim 27 is patentabe under 35 U.S.C. § 103(a) over Marisic (U.S. Patent No. 2,384,946) in view of Fernholz et al. (U.S. Patent No. 3,939,199) and Frank et al. (U.S. Patent No. 5,789,075).

VII. ARGUMENTS

i) Whether claims 14-22, 26, and 28 are patentable under 35 U.S.C. § 103(a) over Marisic (U.S. Patent No. 2,384,946) in view of Fernholz et al. (U.S. Patent No. 3,939,199) and optionally further in view of Mielke et al. (U.S. Patent No. 5,656,195)

Claims 14-22, 26, and 28 have been finally rejected under 35 U.S.C. § 103(a) as being unpatentable over Marisic (U.S. Patent No. 2,384,946) in view of Fernholz et al. (U.S. Patent No. 3,939,199) and optionally further in view of Mielke et al. (U.S. Patent No. 5,656,195).

On page 1, the Final Office Action states that Marisic discloses a process of producing hydrogel pellets by continuously contacting within an enclosed mixing chamber such as an injector or nozzle mixer, streams of reactant solutions of such concentration and proportions that no gelation occurs with the mixer, but only at some predetermined time after leaving the mixer, and under such conditions of flow that each stream is completely and uniformly dispersed within and throughout the other at the instant of contact. The Final Office Action also states that the resultant colloidal solution is ejected from the mixer through an orifice or orifices of suitable size so as to form globules of the solution which are introduced into a fluid medium where the globules of the colloidal solution set to a gel before they pass out of the medium. The Final Office Action further identifies other features of Marisic, including the formation of pellets by a process analogous to spray drying wherein the gelable solution is sprayed into a drying tower, that the fluid medium can be constituted of a gas such as air, and that the medium may contain components which can be dissolved therefrom by the hydrosol, and concludes that it would have been obvious to one skilled in the art to select any embodiment among the specifically disclosed embodiments.

On page 2, the Final Office Action also states that Marisic further discloses that the fluid medium is maintained at temperature below the boiling point of the sol and that, after setting is complete, the hydrogen may be washed, base exchanged, heat treated or otherwise processed to obtain the desired physical and chemical characteristics in the final product. The Final Office Action considers this product to be the same as the claimed aerogel since the resulting gel possesses open pores free of liquid.

While the Final Office Action notes that Marisic does not specifically disclose the temperature of the process, the conclusion is drawn that it would have been obvious to optimize these process conditions to obtain the best results and that it would have been obvious to dry the hydrogel to obtain aerogel, since aerogel is desired in the art. The Final Office Action adds that, in the event that the heat treating step of Marisic is not sufficient to convert the hydrogel to aerogel, Mielke et al. teaches that silica aerogel particles, which are desired to be used in moldings, can be produced by solvent exchange and subsequent supercritical drying of a silica hydrogel. The Final Office Action therefore concludes that it would have been obvious to one of ordinary skill in the art to convert the hydrogel of Marisic to aerogel because aerogel is desired to be used in moldings as suggested by Mielke et al.

The Final Office Action also notes that Marisic does not disclose that the fluid is moving substantially against the direction of gravity. However, the Final Office Action states that Fernholz et al. discloses that for a spray-drying process for converting a sol to a gel, in order to avoid damage of the gelled and still soft particles, they can be sprayed in an upward inclined direction and collected in a liquid bath (for example water) or they can be conducted in counter current flow with a current of air or gas which reduces their impact velocity and simultaneously improves their resistance by drying. The Final Office Action therefore concludes that it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a current of air or gas in counter current flow with the spray of silica sol in the process of Marisic, as suggested by Fernholz et al. because such counter current flow of air would reduce the silica gels impact velocity and improve their resistance by drying.

On page 3, regarding claim 20, the Final Office Action further concludes that the subject matter as a whole would have been obvious to one having ordinary skill in the art at the time the invention was made to have used both the water bath and the counter current flow of air to avoid damage of the gelled and still soft particles, because combining two or more ways as disclosed in Fernholz et al. for the same purpose has been held to be a prima facie case of obviousness.

On pages 4-5, the Final Office Action addresses Appellants' previous arguments. In particular, while Appellants argued that Marisic teaches that "it is essential to the formation of a structurally strong pellet that the sol not be mechanically disturbed during the time of setting", Marisic further teaches that evaporation of water in the sol tends to generate steam which not only mechanically disturbs the gel structure during formation but also introduces gas bubbles of large size compared with the size of the pellet, and the fluid medium should therefore be maintained at a temperature below the boiling point of the sol until the same has set to firm hydrogel. The Final Office Action adds that the only exemplified "mechanically disturbed" is when the temperature is higher than the boiling point of the sol, since Marisic even disclosed a flow against gravity which does not appear to cause the "mechanically disturbs".

Furthermore, the Final Office Action states that, while Appellants argued that Marisic does not disclose a medium that flows against the direction of gravity, Fernholz et al. is applied as stated above to teach a medium that flow against the direction of gravity as required in the present claims.

Also, the Final Office Action states that, while Appellants argued that Marisic is a water-immiscible liquid heavier than water, with a water layer above, it should be noted that Marisic discloses that the fluid medium may also be constituted of a gas such as air.

Finally, the Final Office Action states that, while Appellants argued that Mielke cannot cure the deficiencies of Marisic, this reference is only used to teach that silica aerogel particles are desirable to be used in molding, not to teach a process in which a lyosol is introduced into an atmosphere which flows substantially against the direction of gravity.

Appellants continue to respectfully disagree. Regarding claims 14-22 and 26, claim 26 recites a method of producing substantially globular aerogels wherein i) gel forming components are mixed to produce a lyosol, ii) the lyosol is introduced into an atmosphere which flows substantially against the direction of gravity to form a substantially globular lyogel, and iii) the substantially globular lyogel is converted to an aerogel.

As noted in the Final Office Action, Marisic does not disclose that the fluid is moving substantially against the direction of gravity. For this reason, Fernholz et al. has been applied for the countercurrent flow method used to minimize damage to the described "gelled and still soft particles" and used to finally conclude that it would have been obvious to use this method in the process of Marisic because such countercurrent flow would reduce the silica gels' impact velocity and would improve their resistance by drying.

However, Appellants continue to believe that these references would not be combined by one skilled in the art. As acknowledged by the Office Action mailed October 11, 2006, Fernholz et al. and Marisic each relate to very different types of particles – the sol or gel of Fernholz et al. is not silica as in Marisic. While the Final Office Action also states that, since Fernholz et al. discloses a spray-drying process for converting a sol to a gel in which spraying occurs in an upward inclined direction or using a countercurrent flow of air or gas, in order to avoid damage to the gelled and still soft particles, Appellants continue to believe that one skilled in the art would not apply the countercurrent flow of Fernholz et al. to the silica sol or gel of Marisic. Rather, Appellants believe that Marisic clearly teaches that such a countercurrent flow would not be possible with the gels prepared in the described process.

For example, Marisic teaches that, "[w]hether the fluid medium is gaseous or liquid, it is essential to the formation of a structurally strong pellet that the sol not be mechanically disturbed during the time of setting" (see page 2, second column, lines 1-5). Even evaporation of water from the sol "disturbs the gel structure during formation" (see page 2, second column, lines 5-14). Also, the shape of the formed gel is affected by the type of fluid medium and the rate at which the colloidal solution travels through it (see page 2, second column, lines 56-66).

Thus, the globules of the sol can result in gel having flat or disc-like shapes, depending on the medium, thereby loosing their spherical shape.

In addition, while Marisic teaches a flow against gravity, there is no description that the medium flows against the direction of gravity, as is recited in the present claims. For Example, Figure 4 of Marisic shows an embodiment in which the apparatus is adapted for upward flow of the colloidal solution during gelation (see page 3, second column, lines 67-75). While the colloidal solution flows upward, the medium is stationary. Thus, there is no countercurrent flow, in which the flow of the colloidal solution goes against the flow of the medium. Such an embodiment is completely consistent with the requirement stated in Marisic that "the sol not be mechanically disturbed during the time of setting".

Since Marisic clearly teaches that the spherical sols become damaged or can lose their shape if mechanically disturbed, one skilled in the art would avoid using any method which would disturb the sol, and this would include the countercurrent flow of Fernholz et al. Thus, Fernholz et al. does not suggest a solution that can be applied to the sol of Marisic, and therefore Appellants believe that one skilled in the art would not combine the teachings of these references, thereby arriving at the present invention.

Regarding Mielke et al., Appellants believe that this reference also cannot cure the deficiencies of Marisic. In particular, while Mielke et al. shows that a silica aerogel can be produced by solvent exchange and subsequent supercritical drying of a silica hydrogel, there is no teaching or suggestion anywhere in Mielke et al. of a process in which a lyosol is introduced into an atmosphere which flows substantially against the direction of gravity. Furthermore, whiel the Final Office Action states that this reference teaches that aerogel particles are desired to be used in moldings, none of the present claims recites a molding.

Therefore, since Marisic cannot be combined with Fernholz et al. and since Mielke et al. cannot cure the deficiencies of Marisic, Appellants believe that claim 26 is patentable over Marisic in view of Fernholz et al. and optionally further in view of Mielke et al. Claims 14-22, which depend either directly or indirectly from claim 26, recite further embodiments of the present invention and, for at least the reasons discussed above, are also patentable over this combination of references.

Regarding claim 28, this claim recites a method of producing substantially globular aerogels wherein gel forming components are mixed to produce a hydrosol, the hydrosol is introduced into an atmosphere which flows substantially against the direction of gravity to form a substantially globular hydrogel, and the substantially globular hydrogel is converted to an aerogel. The hydrosol is formed from silicic acid and mineral acid, and the substantially globular hydrogel is trapped in a layer of water. Appellants believe that claim 28 is also patentable over Marisic in view of Fernholz et al., optionally further in view of Mielke et al. for at least the reasons discussed above. In addition, there is no disclosure in Fernholz et al. of either the formation of a hydrosol from silicic acid and mineral acid or of trapping substantially globular hydrogels in a layer of water. Therefore Appellants believe that claim 28 is patentable over this combination of references.

Appellants therefore believe that claims 14-22, 26, and 28 are patentable over Marisic in view of Fernholz et al., optionally further in view of Mielke et al. and respectfully request that the rejection of these claims be reversed.

ii) Whether claim 27 is patentabe under 35 U.S.C. § 103(a) over Marisic (U.S. Patent No. 2,384,946) in view of Fernholz et al. (U.S. Patent No. 3,939,199) and Frank et al. (U.S. Patent No. 5,789,075).

Claim 27 has been rejected under 35 U.S.C. § 103(a) as being unpatentable over Marisic (U.S. Patent No. 2,384,946) in view of Fernholz et al. (U.S. Patent No. 3,939,199) and Frank et al. (U.S. Patent No. 5,789,075).

On page 3, the Final Office Action states that Marisic and Fernholz et al. are applied as stated in the above rejection and notes that the difference not yet discussed is that Marisic does not teach the silylation step. For this reason, Frank et al. is applied, and the Final Office Action states that this reference discloses that the term aerogel encompasses xerogels and cryogels and that it is known in the art to convert gels into xerogels by modifying the gels by silylation in such a way that the gels can be dried without collapsing. The Final Office Action therefore concludes that it would have been obvious to one of ordinary skill in the art to convert the gel of Marisic into an aerogel (i.e., xerogel) by first silylating the gel, as suggest by Frank et al. in order to dry the gel without collapsing the gel structure because Frank et al. teaches that aerogel is a desired product in the art.

Appellants continue to respectfully disagree. Claim 27 recites a method of producing substantially globular silylated lyogels wherein gel forming components are mixed to produce a lyosol, the lyosol is introduced into an atmosphere which flows substantially against the direction of gravity to form a substantially globular lyogel, and the substantially globular lyogel is reacted with a silylating agent to form a substantially globular silylated lyogel. As discussed in more detail above, Appellants do not believe that one skilled in the art would combine Marisic and Fernholz et al. since each of these references relate to very different types of particles and since the clear teaching of Marisic that it is essential to the formation of structurally strong pellets that the sol not be mechanically disturbed during the time of setting would lead one skilled in the art to avoid the countercurrent flow method of Fernholz et al., since such a process would be expected to damage the sol as it sets to a gel.

Furthermore, regarding Frank et al., Appellants believe that this reference cannot cure the deficiencies of Marisic. In particular, while Frank et al. does disclose that hydrogels may be modified by silylation, there is no teaching or suggestion anywhere in Frank et al. of a process in which a lyosol is introduced into an atmosphere which flows substantially against the direction of gravity.

Therefore, since Marisic cannot be combined with Fernholz et al. and since Frank et al. cannot cure the deficiencies of Marisic, Appellants believe that claim 27 is patentable over Marisic in view of Fernholz et al. and Frank et al. and respectfully request that this rejection be reversed.

Conclusion

For the reasons discussed above, Appellants believe that the rejections of the claims of the present application should be reversed and this application should be allowed to pass to issuance.

Respectfully submitted,

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VIII. CLAIMS APPENDIX

14. A method according to claim 26, characterized in that the atmosphere is air.

15. A method according to claim 14, characterized in that the air contains at least one further gaseous medium.

16. A method according to claim 14, characterized in that the lyosol is introduced dropwise into the air.

17. A method according to claim 14, characterized in that the lyosol is sprayed into the air.

18. A method according to claim 14, characterized in that the lyosol is screened according to size by the air which is directed in opposition to gravity.

19. A method according to claim 14, characterized in that the velocity of the air diminishes in the direction of flow.

20. A method according to claim 26, characterized in that the substantially globular lyogel is trapped in a layer of water.

21. A method according to claim 26, characterized in that the lyosol is formed from silicic acid and mineral acid.

22. A method according to claim 26, characterized in that the lyosol is formed from a sodium water-glass solution and hydrochloric acid.

26. A method of producing substantially globular aerogels wherein:

i) gel forming components are mixed to produce a lyosol;

ii) the lyosol is introduced into an atmosphere which flows substantially against the direction of gravity to form a substantially globular lyogel; and

iii) the substantially globular lyogel is converted to an aerogel.

27. A method of producing substantially globular silylated lyogels wherein:

i) gel forming components are mixed to produce a lyosol;

ii) the lyosol is introduced into an atmosphere which flows substantially against the direction of gravity to produce a substantially globular lyogel; and

iii) the substantially globular lyogel is reacted with a silylating agent to form a substantially globular silylated lyogel.

28. A method of producing substantially globular aerogels wherein:

i) gel forming components are mixed to produce a hydrosol;

ii) the hydrosol is introduced into an atmosphere which flows substantially against the direction of gravity to form a substantially globular hydrogel; and

iii) the substantially globular hydrogel is converted to an aerogel;

wherein the hydrosol is formed from silicic acid and mineral acid and wherein the substantially globular hydrogel is trapped in a layer of water.

IX. EVIDENCE APPENDIX

None.

X. RELATED PROCEEDINGS APPENDIX

None.